Appl. No.: 09/902,502
Amdt. Dated: 04/22/2004
Off. Act. Dated: 12/22/2004

REMARKS

Reconsideration of this application is respectfully requested in view of the discussion presented herein.

1. Rejection of Claims 1-39 under 35 U.S.C. § 103(a).

Claims 1-39 were rejected as being obvious and unpatentable over Bokor et al. U.S. 6,555,828) in view of the patent issued to Sweatt et al. (U.S. 6,285,497). The Applicant has carefully considered the rejection and responds as follows:

The examiner has stated, in part:

> "Bokor et al. fails to teach a CCD camera. Sweatt al. discloses diffractive element in extreme-UV lithography condenser, which includes means for simultaneaously imaging/camera 77 multiple points in an area of a mask blank using reflections of light from a light source impinging on the mask blank (as shown in fig. #6A of Sweatt et. al.; col. 12, lines 10). In view of the teachings of Sweatt et al., it would have been obvious to an artisan of ordinary skill in the art at the time the invention was made to employ an CCD/ringfield camera into the teachings of Bokor et al. in order to record the reflected EUV from the mask blank. Furthermore, the use of the CCD/ringfield camera would have been an improvement of the teachings of Bokor et al. by comparing pixel data related to the EUV image either to data corresponding of other portions of the image or to stored data from previous image. Moreover, such modification would have been an obvious extension as taught by Bokor et.al., therefore an expedient."

The Applicant respectfully submits that the subject matter of independent Claims 1, 7, 13, 18, 23, 29, or 35 (as well as the dependent claims) would not have been obvious to a person having ordinary skill in the art in view of the teachings of Bokor et al., and in view of Sweatt et al., in part, because the combination does not render the invention.

It is not readily apparent to the Applicant how these references could be combined to arrive at Applicant's invention as recited in pending claims. In general, the Bokor apparatus scans a small area of a mask blank to detect a defect with two detectors and Sweatt teaches an improved condenser for projection lithography where a mask pattern is scanned and a reduced image is projected onto a small wafer.

Sweatt does not teach registering the projected image of the camera with a CCD array, film or a detector. Sweatt also teaches optics (condenser) between the EUV source and the mask and optics (camera) between the mask and the wafer. This limitation is not present in applicants invention. Further, Sweatt teaches away from simultaneous (full-field) imaging. There is no incentive, suggestion or motivation to exchange the method of detection or "what" is detected from the Bokor patent with the invention or camera disclosed in Sweatt. Accordingly, Applicant submits that the Bokor and Sweatt patents alone or in combination do not disclose a "means for simultaneously imaging multiple points in an area of a mask blank using reflections of light from [an] EUV light source..." and therefore the claims are not obvious in light of the references.

The Bokor patent discloses an apparatus for detecting defects below the surface of a mask substrate that uses a 13 nm light focused on a very small spot on a mask blank and then detecting the intensity of the reflection (bright field), the scattered beam intensity (dark field) and/or the change in the photoemission current. (See the Bokor abstract and Col. 2, lines 55-67). Referring particularly to FIG. 3A of Bokor, the EUV beam is directed from the source 50 through a "glancing incidence optical system having two mirrors 52 and 54 arranged in the Kirkpatrick-Baez (K-B) configuration." (Col. 6, lines 25-27). The K-B optics "are designed to demagnify" the beam before it reaches the sample 40. (Col. 6, lines 35-45). The reflected demagnified beam is detected by a channeltron electron multiplier 60 and the scattered photons i.e. dark field measurements are made with a microchannel plate 62. Demagnification of the EUV beam with mirrors is not a limitation of the present invention.

The Sweatt patent discloses a diffractive element in a lithography condenser (title) that has the effect of smoothing illumination to enhance critical dimension control (abstract). The condenser collects soft x-rays and couples it to the ringfield of a camera designed for projection lithography (col. 1:14+). In this context, Sweatt defines "camera" as; (a) "1X Camera: A camera of the class disclosed in U.S. Pat. No. 3,748,015." (Offner) and (b) "5X Camera: A camera of the class disclosed in U.S. Pat.

No. 5,315,629." (Jewell, et. al.) (col. 7:8-11). The camera in Offner is "an optical system for forming an image at unit magnification." (col. 1:1-2) "incorporate[ing] convex and concave sphereical mirrors arranged with the centers of curvature coinciding at a single point." (col. 1:25-27). Referring to Jewell, the camera is, "a reflecting triplet aspheric mirror system (is) configured for use as [a] reduction projection system in an unobscured ringfield form." (col. 5:30-32)(emphasis added) Further, Sweatt uses the term "projection camera" in claim 17. (col. 16:41-42). In short, the "camera" in Sweatt is a demagnifying projector with reflecting mirrors and not a camera in the conventional sense with film or a CCD array to register the image. The camera optics in the Sweatt apparatus is a limitation not found in applicant's invention. Further, the "projection camera" in Sweatt with an "object:image size reduction of, for example, 5:1 reduction," (col. 4:7), teaches away from applicant's invention where a divergent beam provides that, "with a one-inch square detector array, the measurement area will be in the range of 0.5 inches square." (page 8, line 12-13). Since the camera in Sweatt is a focusing projector and does not use a CCD, a detector or register images, it cannot be, "an improvement of the teaching of Bokor et. al. by comparing pixel data related to the EUV image..."

Sweatt defines full field exposure as, "Simultaneous (rather than sequential) exposure of all subareas of an image field." (col. 8:1-2). Sweatt points out that, "full field imaging, as opposed to ringfield imaging (scanning), requires severely aspheric mirrors in the camera. Such mirrors cannot be manufactured to the necessary tolerances with present technology for use at the required [EUV] wavelengths." (col. 1:61-65). Sweatt discusses the advantages of projection lithography where, " the high-aspect ratio of the synchrotron emission light, has led to use of a scanning high-aspect ratio illumination field (rather than the use of a full-field imaging field)." (col. 3:38-40). Sweatt further describes properties of the parent mirror sets in the condenser and notes, "In a normal, non-scanning system this would give intensity and image quality variations in the radial direction. How ver, the scanning integrates out these radial

variations." (col. 13:3-6). Thus, Sweatt clearly distinguishes full field imaging (simultaneous exposure) from scanning, points out the advantages of scanning with EUV, and teaches away from simultaneous exposure (imaging) of all subareas of an image field (multiple points in an area).

Applicant submits that there is no incentive, suggestion or motivation found in either Bokor or Sweatt for simultaneously imaging multiple points in an area of a mask blank. Accordingly, there is no suggestion, incentive or motivation found in Bokor or Sweatt to combine the detection methods of Bokor with the demagnifying projector camera in Sweatt.

Applicant further submits that the stated combination of Bokor and Sweatt is incompatible and does not disclose the invention. Neither the Bokor nor the Sweatt patents disclose a structure or method to "simultaneously image multiple points in an area" as claimed in the independent claims.

The Bokor apparatus illuminates the mask blank with a microscopic spot of EUV light and compares the intensity readings of the reflected beam and scattered rays from the bright field and dark field detectors. The size of the beam and duration of the exposure, for example, are limitations to the Bokor apparatus and method. At Col. 5, lines 20-24, the scanning time for one embodiment is described. It states: "With a dwell time of 20 μsec on a 1μm spot, it will take 33 minutes to scan a 1 cm by 1 cm area. To detect a 1% fluctuation in the reflected beam with the same signal to noise ratio, the dwell needs to be increased by 25 times." Additionally, the directed beam in Bokor is demagnified to give a wider reflective field as discussed previously.

The Sweatt patent discloses a demagnifying projector camera that does not register images with a CCD or other detector that can be used for inspection in Bokor. Sweatt teaches away from a method to simultaneously image multiple points in an area. In projection lithography described in Sweatt, " Cameras that use only a few surfaces and can image with acuity (i.e., sharpness of sense perception) only along a narrow arc or ringfield [have been developed]. Such cameras then scan a reflective

mask across the ringfield and translate the image onto a scanned wafer for processing." (col. 1:51-55).

The aforementioned differences, including different beam focusing methods (spot vs ringfield), different reflected beams (divergent vs convergent), and different imaging processes (detector vs wafer), suggest the Sweatt and Bokor patents cannot be combined. Furthermore, neither the Sweatt and Bokor patents individually or in combination suggest or provide incentive or motivation for "means for simultaneously imaging multiple points in an area of a mask blank using reflections of light from [an] EUV light source" as claimed by the Applicant. Bokor does not disclose a "means for imaging" or a "means for simultaneous imaging multiple points." Nor does Sweatt provide a means for "simultaneous imaging of multiple points" using reflections of light from an "EUV light source." As discussed above, the Sweatt apparatus is an improvement on "use of a scanning high-aspect ratio illumination field (rather than the use of a full-field imaging field.". (col. 3:39-40). Consequently, the combination does not provide an essential limitation to the claims.

In summary, there are a number of shortcomings that arise from a combination of the cited references utilized for supporting an obviousness rejection for the purposes of 35 U.S.C. § 103 of Applicant's claims. In view of the cited references Applicant respectfully submits that since all claims of the invention are not obvious, that all claims should be immediately passed to allowance.

2. Conclusion.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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The Applicant also respectfully requests a telephone interview with the Examiner in the event that there are questions regarding this response, or if the next action on the merits is not an allowance of all pending claims.

Date: 4/22/04

Respectfully submitted,

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